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field crops

PROJECT BOOK

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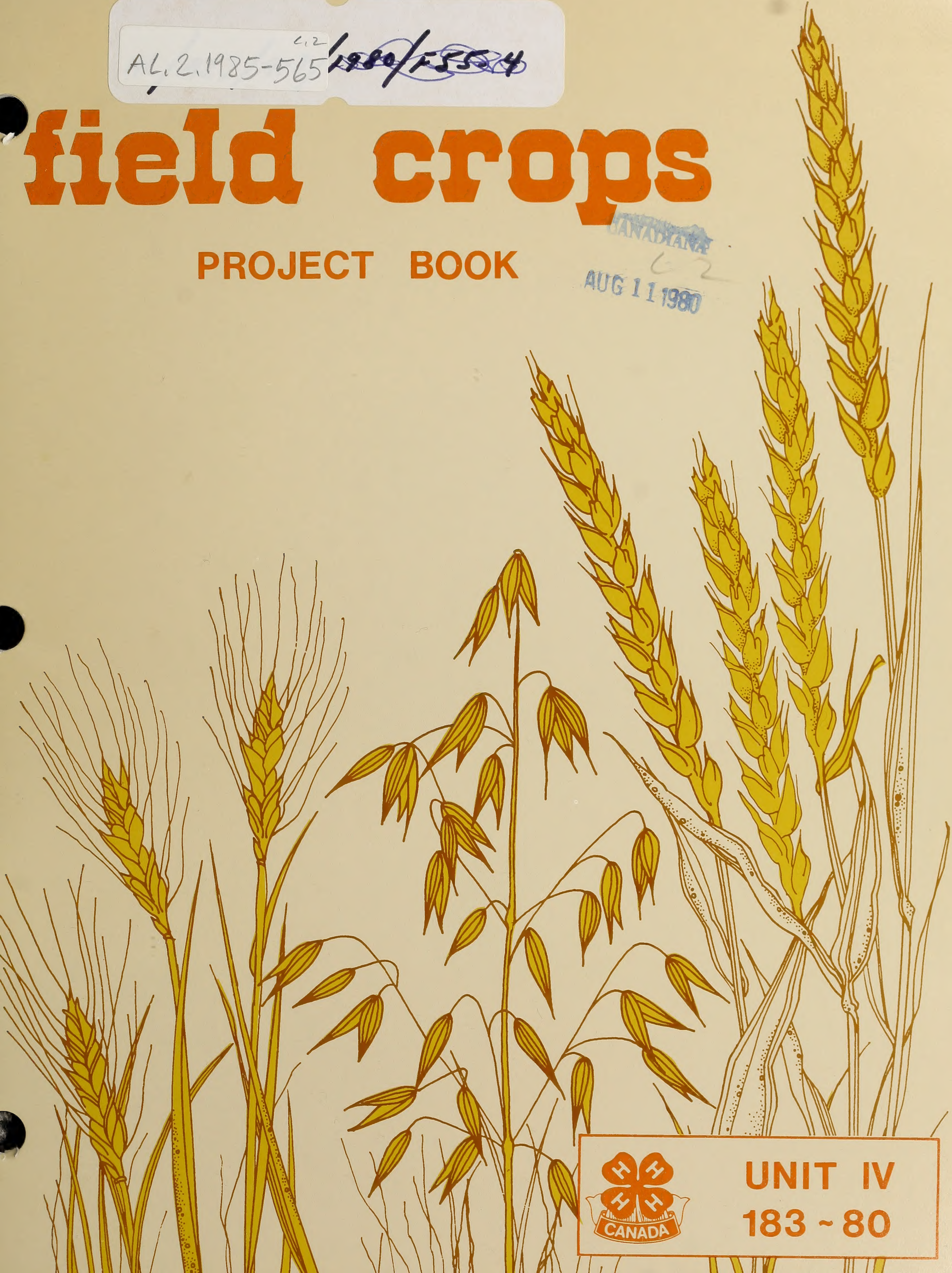

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UNIT IV
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4-H MOTTO

"Learn to do by doing"

4-H PLEDGE

I pledge
My HEAD to clearer thinking,
My HEART to greater loyalty,
My HANDS to larger service,
My HEALTH to better living,
For my club, my community and my country

4-H GRACE

(Tune of Auld Lang Syne)

We thank thee, Lord, for blessings great
On this, our own fair land.
Teach us to serve thee joyfully,
With head, heart, health and hand.

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UNIT IV - WINTER PROJECTS & REFERENCES

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QUALITY OF THE FINAL PRODUCT

In any type of operation, farming or otherwise the quality of the finished product often has a great effect on the final return. This is true of both seed grown from cereal, oilseed or forage crops and the hay in the stack or silage in the silo.

A. SEED QUALITY

For our purposes we will discuss only two different grains, wheat and malting barley, however, many of the points brought out here will also apply to other crops.

1. WHEAT

Damage to the kernel can decrease storage life or flour value and lower the wheat grade. Kernel defects and discoloration can interfere with germination and early growth of the seedling. According to the United Grain Growers', damage can occur before harvest, during threshing, drying, handling or during storage.

Shriveled or green kernels result from immaturity at harvest. Sprouting can be caused by wet weather after wheat has matured, but before harvest. Frost occurring when the wheat is immature, causes blistering of the bran coat and often discoloration of the kernel. Wheat damaged by frost will give low yields of flour and the protein is lower in weight and contains less of certain amino acids.

Improper combine adjustments can break kernels into small pieces which will be removed during the cleaning process. Internal cracks in stored wheat can lead to increased respiratory activity of the kernels, a greater chance of moisture movement and harbor a greater number of mold spores, insect eggs, and bacteria. According to the United Grain Growers' tests it was shown that grain without internal injury can be stored more than twice as long without fungi damage than grain with internal kernel damage.

The gluten quality of wheat can be injured by too much heat during artificial drying or spontaneous heating during storage. Rapid drying and fast cooling can produce minor cracks which lead to breakage during handling.

Cracked grain that is lost as dockage can be caused by not keeping the auger full during handling. According to the United Grain Growers' keeping the auger fully loaded will reduce crackage to less than 1%.

Damage during storage is often greater than that from all other sources. High moisture content (above 14.5% for wheat) is the chief cause of the grain heating and mold damage. Damage from grain heating is usually recognizable by the nugget-brown color of the kernels. Insects can increase the moisture content of grain by as much as 1% per week according to the United Grain-Growers'. This improves conditions for fungi to grow, and causes moldiness, odors or discoloration of the germ.

Other undesirable things that reduce the overall quality of wheat include:

1. Cereal grains other than wheat which cannot be separated as dockage.
2. Foreign material other than cereal grains that cannot be removed. For example, weed seeds, ergot, peas, corn, buckwheat, ragweed and stones.
3. Kernels stained from coming in contact with the juice of weed seeds, such as Russian thistle in moist weather.
4. Any odor that is distinctly objectionable such as smut, chemicals, animal taint, musty conditions or heating.

2. MALTING BARLEY

In order to produce malting barley, the seed must have a high per cent germination and grow vigorously and uniformly. This means kernels must be free of damage. Malting modifies the contents of the barley kernel so that a sugary solution called "wort" can be extracted from it. The solution is then fermented to give beer.

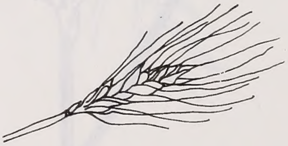
B. HOW TO REDUCE STORED GRAIN LOSSES

According to the United Grain Growers', the following steps should be taken to avoid storage losses.

1. Periodically take samples from different parts of the bin to determine moisture content, temperature and insect activity.
2. In barley, if the moisture content is above 15%, it should be aerated as soon as possible. No germ or heat damage will occur with a moisture content below 13%.
3. The temperature should be between 4.44°C and 10°C throughout the bin (for barley).
4. If even a slight rise in temperature is detected, damage is being done either by vigorously feeding insects or rapidly growing storage fungi.
5. In wheat, moisture content should be below 13% because with a moisture content of 13.5% to 14.5%, slow invasion by storage fungi can cause germ damage without a rise in temperature.
6. Wheat that is heating, even when insects are not present has a moisture content of greater than 14.5% and should be aerated as soon as possible to get the temperature below 4.44°C throughout the bin.

C. FORAGE CONSERVATION

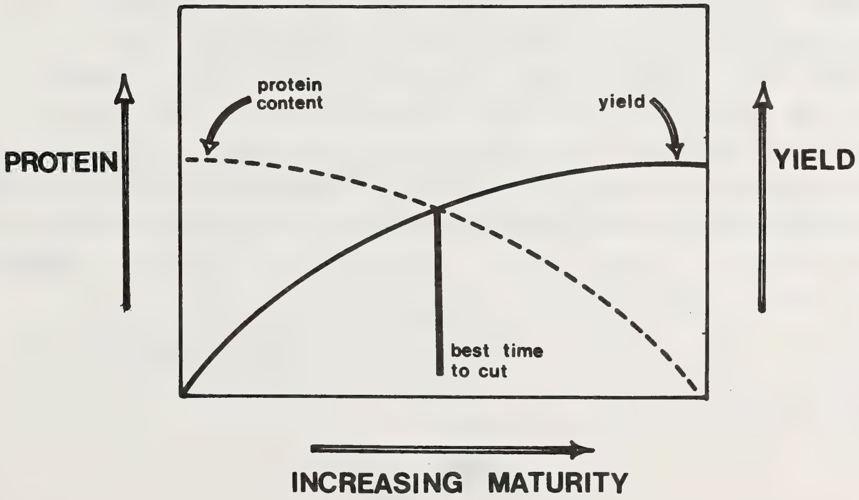
An individual farmer will choose the method of forage conservation that best suits his operation and circumstances, but the objective is always the same--to produce a stable product, of adequate nutritional value, with minimum loss, at reasonable capital and labor costs. All freshly cut forage crops deteriorate rapidly for two reasons: chemical changes within the crop itself and the action of molds and bacteria. The aim of conservation is to create conditions which will halt the process of deterioration. For example, by drying, by acidification or by heating.



1. WHEN TO CUT

The composition of a forage crop varies greatly at different stages of growth. As the crop matures, the protein content rapidly falls, as does the moisture content, and the fibre content gradually increases. Sugar or carbohydrate content reaches a peak just before heading and then drops off. The crop becomes less digestable as it matures. However, the stage just before maturity is also the period of rapid growth. One must try to balance yield with composition and digestibility in order to get the most yield of a high quality product. Ideally, one should aim at cutting the highest possible amount of protein per hectare. The following graph illustrates the relationship between yield and protein content as the plant matures.

RELATIONSHIP BETWEEN YIELD & PROTEIN CONTENT



2. FORAGE LOSSES

As stated by Alex Johnston, forage losses can be grouped into three categories: physical losses, invisible losses, and damage losses.

Physical Losses are those that occur during cutting, crimping, picking up, handling, or because of trampling and spoilage. These losses involve leaf material for the most part. They can lead to a serious drop in protein content and digestibility, especially with legumes.

Invisible losses are not readily seen but affect the soluble and most digestible part of the forage. They can be separated into respiration, fermentation, effluent, and leaching losses.

a. Respiration - As long as a plant contains over 30% moisture and is exposed to oxygen it continues to respire or breath even after it is cut. The process of respiration burns up readily available plant material, producing heat which rises, leading to heated brown hay or overheated dark brown silage.

b. Fermentation - This is the process of chemical breakdown of plant material carried on by micro-organisms like bacteria and molds. This process is essential to silage making, where conditions are created so that bacteria present on the forage ferment the sugars in the forage producing lactic acid, which then pickles the forage and stops further bacterial action. Due to the bacterial activity, fermentation involves some loss, which varies with the type of crop and its moisture content. There is no loss in dry hay, about 5% loss with moisture contents between 20% and 65% and progressively greater loss in wetter crops. Fermentation loss is most serious in silage when the process is prolonged in storage because there is not enough lactic acid produced to form a stable product.

c. Effluent - Once forage is cut, the cell structure can no longer prevent liquid from escaping, so that any liquid in excess of what the mass can hold will run out. The amount depends on the moisture content of the cut forage, the pressure applied, and the amount of soluble material present in the forage crop. Because water is one of the products of fermentation, a high fermentation loss adds to the effluent loss. Effluent contains a high proportion of soluble material from the crop and therefore every effort should be made to avoid these losses.

d. Leaching - This is the washing out of soluble material from the crop by rain. Losses will depend on the amount of water passing through the crop and the amount of soluble material in the crop. It is possible to lose all of the soluble material.

Damage Losses - can reduce nutritive value of the crop in the following ways:

1. Over-heating during conservation can reduce digestibility of crude protein from about 70% to 30% or less.
2. Molds can cause unpalatability, digestive upsets, or actual toxicity in poorly conserved forage.
3. Carotene content of grasses or legumes can be destroyed by excessive sun, rain, or over-heating.

D. TWO METHODS OF FORAGE CONSERVATION

There are essentially two different methods of conserving forages:

1. dehydration or haymaking
2. preservation or silage making

1. HAYMAKING

Forage crops will "keep" without deterioration if the moisture content is reduced to approximately 10-12% for leafy crops and approximately 15-18% for more mature crops. This occurs either slowly by air at natural temperatures when hay is dried in the field, or rapidly as in production of alfalfa "dehy".

When making hay, the crop is baled at about 25% moisture. It later cures down to about 14-15% moisture which is due partly to continued slight respiration in the bale, and partly to the consequent heating of the damp hay which sets up air currents through the stack removing the final moisture.

Leafy grass of high digestibility is hardest to make into hay because of its very high moisture content and the danger of compaction. You must strike a compromise and cut the crop at about the heading stage when yield, carbohydrate content, protein content and digestibility are all reasonably high.

The following losses are the disadvantages of haymaking: loss of leaf during handling, loss of carotene or Vitamin A due to exposure to sun and rain and a slight loss of digestibility.

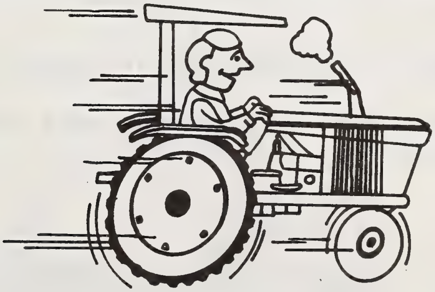
2. SILAGE MAKING

Ensilage is a process in which forages are "pickled". The fermentation of sugars produce enough lactic acid naturally, to prevent harmful organisms from multiplying. The concentration of lactic acid in the silage juice is critical. The wetter the forage is at the time of ensiling, the more acid is needed to preserve it. This is because the wet forage has a higher water to sugar ratio and even though all of the sugar is turned to acid, the silage juice will contain a lower percentage of acid. Thus the concentration of lactic acid may not be high enough to prevent harmful bacteria from multiplying. These bacteria may then attack protein, breaking it down to unpleasant smelling compounds such as butyric acid. Prolonged fermentation can then occur destroying the feed value of the silage.

When making silage, a high sugar content in the crop must be ensured by avoiding cutting at an immature, low sugar stage of growth, and, by avoiding late top dressings of nitrogen that reduce sugar content and increase protein content. Wilting in the field can effectively increase low sugar content. The drier silage produced is stable at a lower concentration of lactic acid in the juice.

Continued respiration or breathing of the crop uses up valuable sugar and can be stopped by cutting off the supply of oxygen. The oxygen trapped in the silage mass is soon used up and if further air is prevented from entering, respiration losses can be low. However, if air is allowed to enter the mass and continued respiration occurs, heat is produced and a cycle starts in which heated air rises within the silage mass and more air is drawn in. If the mass becomes very hot, protein becomes less and less digestible and the additional respiration increases invisible losses. If the silage mass is carelessly packed and the silo not sealed properly, over-heating is almost certain to occur.

Here again, as with haymaking, some compromise has to be made between high digestibility and protein content in young, leafy forages and the ease of ensiling more mature crops containing more sugar and less water. Cutting of silage crops is usually done at a stage intermediate in terms of maturity and protein content between young leafy forages and field cured hay.

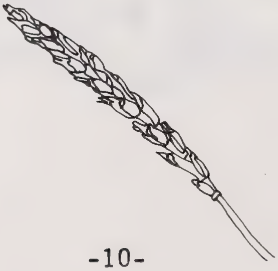


SAMPLES FOR EXHIBITION

A. SEED SAMPLES

The following points taken from Field Crops Branch, The Preparation of Seed for Exhibition (3), are worth considering if you want to produce a quality seed sample from your 4-H plot:

1. Use registered or certified seed for your plot to ensure purity as to variety and freedom from other kinds of grain and weeds.
2. Sow your plot on a clean field.
3. Before harvesting, rogue out diseased plants, off types, admixtures and weeds.
4. Do not use rank growing later maturing material because grain from these plants usually lacks uniformity, ripeness, and quality.
5. Wheat and oats should be cut when fully mature, but not bleached. Barley should be cut when the kernels are firm and wrinkles have begun to form.
6. Individual kernels should be large and plump, of high quality for the purpose intended, sound, bright in color with good lustre and apparently of high vitality.
7. The kernels should be uniform in all of the above respects.
8. The sample should be high in weight per unit.
9. The sample must be free from weed seeds and all other impurities.



10. Use a fanning mill with a strong wind blast to remove chaff and other light impurities. The size of the screens to be used will vary with the kind of grain, the sample, and the year. Large coarse kernels and shrivelled kernels should be removed in this screening process. Run the grain through until only about one-fifth of the original amount remains.

11. The clean grain should be hand screened to improve uniformity. At least one large screen should be used to remove large coarse kernels and one smaller screen to remove shrivelled or misshapen kernels.

12. If the sample is hand-picked strive for uniformity of size, shape and color. The color can be best judged when working at a north light.

13. Samples may be polished by filling a grain sack about one-third full and then working it back and forth. Silk or velvet can also be used for this purpose. Oats and barley are easily injured and great care is needed when polishing these grains. The hull should not be worked down so close as to expose the endosperm.

14. The preparation of grain for exhibition is an art. Every successful exhibitor has his own methods. The best way to learn is by doing.

Here is a sample score card that could be used for wheat, oats, barley, flax or rye:

	PERFECT SCORE	SAMPLE SCORE
1. Purity --		
(a) Free from weed seeds..................	35	....
(b) Free from other crop seeds............	10	....
(c) Free from inert material..............	10	....
(d) Free from evidence of rust, smut, ergot and other diseases.............	10	....
TOTAL PURITY..........................	65	....
2. Quality --		
(a) Grain sound, well ripened, free of damage from frost, broken or damaged kernels................................	15	....
(b) Grain uniformly plump and relatively large for the variety, weighing well per measured bushel.................	10	....
(c) Color uniformly bright, not weathered.	10	....
TOTAL QUALITY.........................	35	....
TOTAL SCORE..............................	100	....

Weight per measured bushel..................................

B. HAY AND SILAGE SAMPLES

Hay samples usually consist of a waffer taken from a bale and packaged in a plastic bag for easy viewing. Silage samples are also packaged in a sealed plastic bag in order to keep the odor in.

PEDIGREED SEED PRODUCTION

The Canadian Seed Growers' Association has prepared and published a booklet, Circular No. 6-73, called Regulations and Procedures for Pedigreed Seed Crop Production. If you are interested in possibly growing pedigreed seed on your 4-H plot you should consult this publication. It can be obtained from your local District Agriculturalist's office or by writing to The Canadian Seed Growers' Association, Box 8455, Ottawa, Ontario, K1G 3T1, Canada. The booklet contains all the recommended procedures and regulations for production of pedigreed seed.

The following are recommended procedures for the production of pedigreed seed crops which are taken from the above mentioned booklet. They will give you some idea of what is involved in pedigreed seed production.

1. Keeping of Records

Keeping a complete record of all seed operations; for example, a year-to-year diagram of the farm indicating:

a. field numbers
b. crop acreages
c. kinds and varieties of crops grown
d. pedigree of seed used to plant each crop, and
e. the Crop Certificate number issued for each crop.

Keep a record of the number of bags and tags, and the pedigree number of the seed purchased.
Files should include Crop Certificates, Pedigree Reinstatements, Seed Testing Certificates, Seed Certificates, Pedigreed seed tags, and other documents.

2. Land to Use

Choose land for the production of Pedigreed crops which meets requirements with respect to previous crops and isolation as outlined in the regulations for each crop kind.

3. Regulations

Study the regulations and plan operations to meet all applicable regulations. If in doubt as to the correct procedure write the Association for further information.

4. Purchasing of Seed

Pedigreed seed purchased for the production of a Pedigreed crop must be identified by the proper tag and seal. The Pedigree of the seed and the seed grade are shown on the tag. All tags must be kept as confirmation of Pedigree.

5. Mechanical Handling of Seed

Thoroughly clean all equipment used in the production of Pedigreed seed, particularly when the same equipment is used for a different variety or kind of seed.

6. Application for Crop Inspection and Application for Membership

The Application for Crop Inspection is also an Application for Membership in the Association. This form must be completed in duplicate and both copies, accompanied by the appropriate fees, must be mailed to the Association, Ottawa, in order that arrangements may be made for the inspection of the crop. One copy of the completed application is forwarded by the Association to the appropriate district office of the Plant Products Division, Canada Department of Agriculture.

In the case of partnership, the application form must be signed by all members of the partnership.
When a crop is being produced under contract, a copy of The Canadian Seed Grower's Association Form 179 assigning the Crop Certificate to the contracting organization should accompany the Application for Crop Inspection.

The application form and Form 179 are available upon request from the Association, the district office of the Plant Products Division, Canada Department of Agriculture, or from the Branch Secretary of the province in which the applicant resides.

7. Preparation of the Crop

Roguing, to be effective, should be done at a time when impurities and off-types can be readily identified. Isolation must be provided and roguing completed prior to crop inspection.

8. Crop Inspection

All official and interagency tags from bags of seed used to plant each crop must be available to the inspector for verification of pedigree. These tags must be retained and forwarded to the Association on request. The Crop Certificate must be available to the inspector when seed produced by a grower is used for planting on land under his control.

9. Separation of Seed Stocks

All equipment used to harvest, process or treat the seed crop must be thoroughly cleaned.
Seed derived from each field should be stored separately from that of all other fields.

10. Requirements of Membership

The following requirements must be met before a Certificate will be issued:

a. The application, accompanied by the appropriate fees for inspection and membership in the Association, must be accepted by the Association.
b. The appropriate Branch fees must be paid to the Association.
c. Crops must meet the crop standards as outlined in the regulations.

11. Preliminary Steps to Seed Inspection

a. Seed Testing

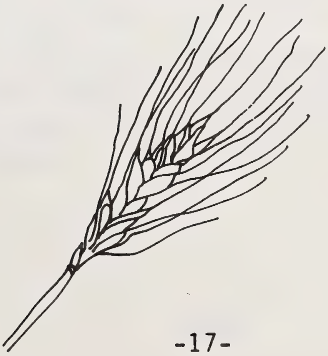
When seed has been harvested a representative sample should be sent to the district office of the Plant Products Division, Canada Department of Agriculture, with a request for a germination test or a Seed Testing Certificate. The quantity of seed to forward for each crop is outlined in the Seeds Act and Regulations, copy of which is available from the district office of the Plant Products Division.

b. Applying for Seed Inspection

An application for Seed Inspection will be enclosed with the Crop Certificate. This form is to be completed and forwarded to the district office of the Plant Products Division, Canada Department of Agriculture, when seed inspection is required.

c. Declaration of Grower Form

A Statutory Declaration of Grower form will also be enclosed with the Crop Certificate and the Application for Seed Inspection. This dual purpose form, supplied by the Canada Department of Agriculture, may also be obtained from the district office of the Plant Products Division. One side of the form is to be completed by the grower and one side by a dealer or person authorized under Section 26 of the Seed Regulations to tag and seal seed or sell bulk certified seed. The completed Application for Seed Inspection, Grower Declaration, and Seed Testing Certificate, together with the Crop Certificate, are the documents required for seed sealing to complete the pedigreeing procedures.



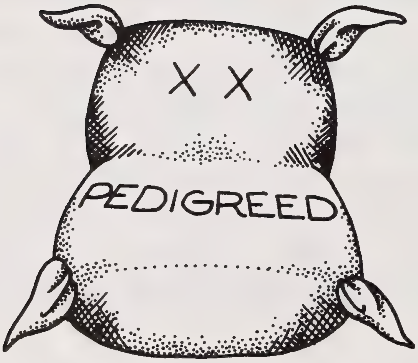
12. Processing of Seed

If the grower processes his own seed:

a. he must prevent contamination from foreign seed.
b. he must never intentionally process to the minimum standards required for the desired grade, and he should consider the advisability of using a recommended seed treatment.
c. when shipping Pedigreed seed, each lot in the shipment should be kept separate.

13. Fees

Payments must be made direct to the Association. Cheques should be made payable at par in Ottawa. Money Orders and cheques must be made payable to **"THE CANADIAN SEED GROWERS' ASSOCIATION"** .



PLANT DISEASES

Diseases of crop plants are of great economic importance in agriculture. They cause a reduction in yield. The crop produced will probably be given a lower grade. The seed produced is not suitable for planting. A diseased crop produces less grain worth less money, and which is useless for seed.

Plant diseases are caused by fungus, bacteria or virus. Some problems may be mistaken for disease but may actually be caused by soil deficiencies, irregular water supply, frost, heat or improper storage.

A. FUNGUS DISEASES

You are familiar with some kinds of fungus. Mushrooms and toadstools are common examples.

Examples of fungus diseases found in field crops include bunt of wheat, stem rusts, loose smut of wheat and barley, and ergot in rye.

Fungus do not have the ability to produce their own food. They lack chlorophyll, the substance which gives plants their green color and which enables them to produce food from water and carbon dioxide in the presence of sunlight. Fungus must take their food from green plants. (Some fungus decays dead plant material such as logs and manure.) Some grow on living plants. These are the disease causing fungus.

The seeds of fungus are microscopic, single celled bodies called "spores". They are carried on the wind, or in water from plant to plant and field to field. The spores germinate on host plants and send out root-like "mycelium". These thread-like structures enter through tiny openings and breathing pores, and take food and water from the host plant. In this way they cause disease. Even once the fungus has completed its life cycle and releases spores to infect new plants, the host plant suffers from loss of water through its destroyed plant covering.

B. BACTERIAL DISEASES

Bacteria are single celled organisms which cause disease in man, animals and plants. Bacteria are so small that they don't bother producing seeds. Each bacteria just changes into a travelling stage.

Blights on many agricultural crops are caused by bacteria. Bacteria are spread by wind, water, insects and farm implements.

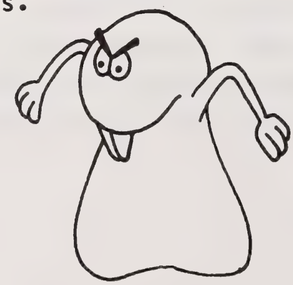
C. VIRUS DISEASES

Virus diseases are important but they have not been studied very much. The virus is a strange thing. It is living, in some ways, and non-living in others.

A virus is so small it can be seen only with a very powerful electron microscope. Each virus attaches itself to one cell, and it takes over the control of that cell.

Diseases such as barley stripe mosaic, barley yellow dwarf and aster yellows are caused by virus.

Viruses are usually spread by an insect carrier. Weeds, such as aster yellows, contain viruses and insects can spread them into the crop from the weeds.



D. CONDITIONS WHICH ENCOURAGE THE SPREAD OF DISEASE

Diseases have become more serious as agriculture has become more intensive.

The entire mid-west of Canada and the U.S.A. is used to produce cereal crops and other special crops. If an epidemic starts in one part of the prairies it can easily spread throughout the entire area.

One crop may be grown on land year after year. This allows large populations of bacteria or fungus to gather in the soil, creating a worse disease problem year after year. Many diseases can be prevented with proper crop rotation.

Diseases may be spread by spores and bacteria travelling on the wind or by insects. This can spread a problem from area to area. Many diseases are spread by water or by spores in the soil.

E. CONTROL OF DISEASE

RESISTANT VARIETY - The most effective way to control the spread of plant disease is to use resistant varieties. Plant breeders are kept busy producing seed with all the good characteristics of old varieties, and with resistance to the most serious plant diseases. Some diseases change and start affecting previously immune varieties. Rusts are especially noted for doing this. When this happens, plant breeders rush to create a new variety before the disease reaches epidemic proportions and complete crop failure occurs.

USE GOOD SEED - It is also important to use good seed. It should be free from all disease organisms such as spores. If using your own seed be sure to use only the largest. Small, shrivelled kernels may be infected. You should use sound seed which isn't cracked or damaged. Chemicals can be added to the seed to kill any disease organisms present. Seed treatment like this can be expensive. To be sure you have a disease free source use certified seed.

CROP ROTATION - To control diseases you should be very careful in planning a crop rotation. Crops such as sunflowers and peas should not be grown year after year on the same fields.

SANITATION - When diseases are present it is important to destroy crop residues where spores or bacteria might stay over the winter. Burning, deep tilling and destroying the trash cover are all desirable from this point of view but are often not desirable for soil conservation. For this reason crop rotation is often a better solution.

DUSTING AND SPRAYING - Fungicides and other chemicals may be used on vegetable crops or small plots but generally they are too expensive to be used on crops.

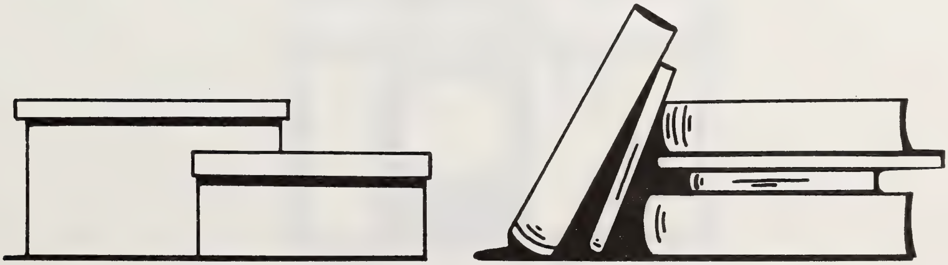
F. COLLECTING PLANT DISEASE SPECIMENS

Identifying plant diseases and collecting diseased specimens can be an interesting and valuable hobby.

The local office of Alberta Agriculture has books and pamphlets to help identify plant diseases. The District Agriculturalist and other staff will help you have samples identified.

The best way to collect samples of diseased plants is to plan a field trip.
Find out from the District Agriculturalist if there are any diseased fields in the area which he knows about. Check with leaders and members to see if they know of any. Then plan a tour including these areas and others. Be sure to obtain the permission of the landowners before trespassing on their land.

On your field trip take along telephone books or catalogues to hold leaves and stems, and boxes to hold larger plant parts. Be sure to keep a record of where plants were found and what they are.



G. PRESERVING SPECIMENS

In order to make a good, permanent collection, you must take a lot of care in preserving your specimens.

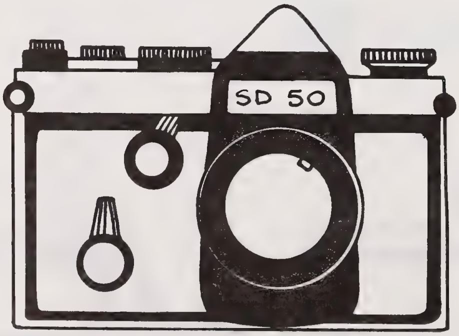
Flat material such as leaves, stems and grain heads can be pressed between blotters (see the section on Weed Collections for full instructions). The pressed plants can be taped or glued to heavy paper and covered with plastic.

Bigger specimens can be dried or preserved in fluid. Some fungus specimens are quite large and can be dried out and mounted in a box. Soft, gelatinous or fleshy specimens will have to be preserved in a solution in a closed jar. The preservative is made by mixing 2.28 litres of water with 56 ml of formaldehyde (40%), and 336 ml of alcohol.

Be careful when handling these chemicals and follow all directions on their labels. You can make a smaller amount if the proportions are kept the same (e.g. 32 tablespoons water, one tablespoon formaldehyde, five tablespoons alcohol).

Taking photographs is another way of preserving examples of disease. The photos should be clear, centered and of good quality.

All specimens should be labelled with the name of the diseased plant, the name of the disease, the place where the plant was collected, the date it was collected, name of the collector and any other pertinent information.



HOW TO MAKE A GOOD COLLECTION

1. Have a reasonable number of specimens. You should have at least ten samples.
2. You should have variety - a number of different diseases and different crops.
3. You should use different preserving methods.
4. The quality of specimens should be good.
5. The collection should be neat, complete, labelled and should show some personal touches.

INSECTS

Everyone knows some insects. Who hasn't been bitten by a mosquito or bothered by a housefly? People think of insects as friends or foes. "Friendly" insects produce commercial products such as honey. They pollinate plants ensuring the production of seeds and fruits. They may destroy "enemy" insects.

"Enemy" insects attack and annoy man and his animals or his crops. They transmit diseases and feed on plants or animals. There are many different kinds of insects. It is suggested that insects destroy 10 percent of all agricultural produce on the prairies. Yet 90 percent of all insects are neither harmful nor beneficial to man.

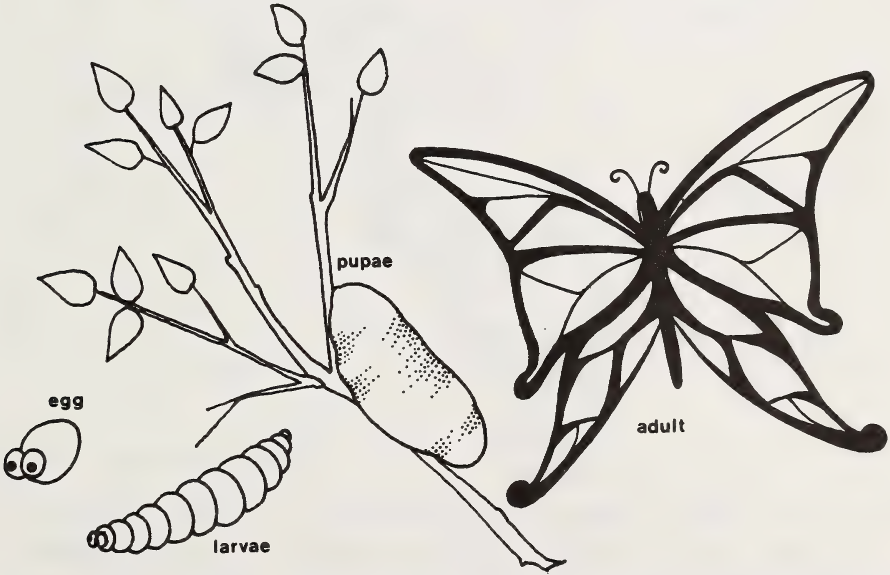
Think and talk about harmful insects. With your club members and leaders think about the many ways insects can be harmful. Put down your ideas.

A. WHAT IS AN INSECT?

Man has classified all forms of life on earth into groups. Insects are part of a group called Anthropods. All the creatures in this group have hard external shells. Lobsters, crayfish, spiders, scorpions, and centipedes as well as insects are Anthropods.

Insects are in a separate family because they have certain special characteristics. They all have bodies which are divided into a head, a thorax and an abdomen.

Even insects are classed in different groups according to different body features. Insects have various kinds of mouths. Grasshoppers have biting mouths, butterflies have sucking mouths, and mosquitoes have piercing and sucking mouths. Most insects have wings but some wings form protective covers such as the beetle; some wings are for flying as those of the dragonfly and some are for flying and balancing as on the fly. Insects are grouped by scientists on the basis of these differences.



Many insects undergo metamorphosis - a complete change in shape and form. Butterflies and moths are common examples.

Other insects hatch from the eggs as a tiny replica of the adult. Grasshoppers grow in this manner.

It is interesting to learn the life story of some common insects.

When insects are harmful it is important to learn about them so we can learn how to destroy them.

The best way to learn about insects is to keep an insect collection, and, to read books and pamphlets containing information about them.

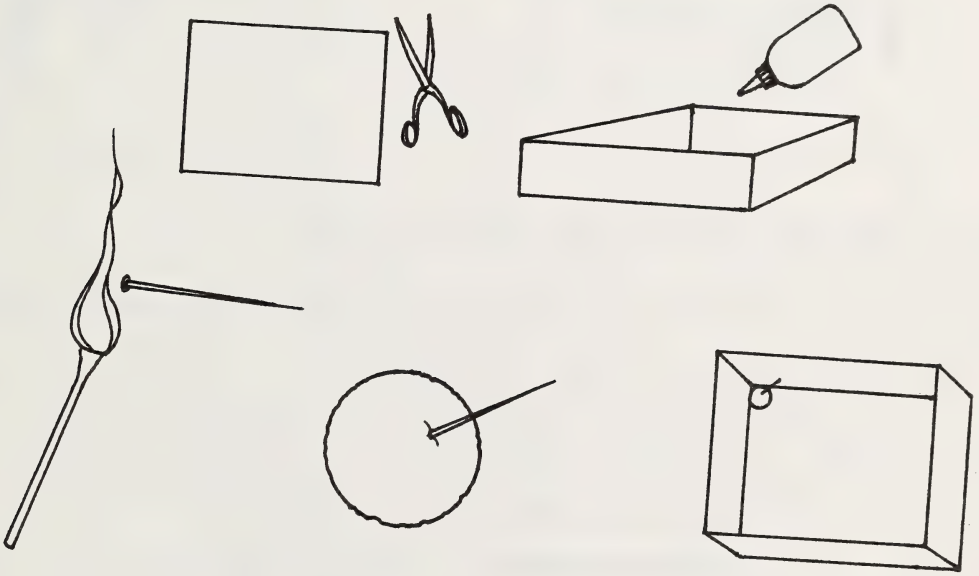
B. KEEPING AN INSECT COLLECTION

You may be interested in insects and want to start an insect collection. You will need a collection box, a net, a killing bottle, and, a spreading board, pinning block, pins and labels.

C. MAKING COLLECTION EQUIPMENT

A COLLECTION BOX

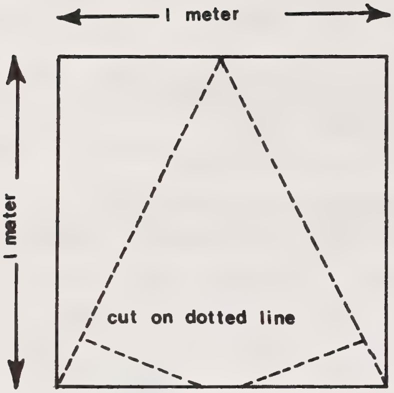
1. Gather together: A cigar box, 5 X 15 X 20 cm preferred; a piece of double faced corrugated cardboard or soft fiberboard; glue; moth balls, common pins.
2. Cut the cardboard to fit the bottom of the box.
3. Smear glue on the box bottom and insert cardboard.
4. The box lid may be lined with white paper.
5. Heat the head of a pin with a lighted match.
6. Insert the hot pin head into a moth ball and cool.
7. Stick the moth ball on the pin into the corner of the box.

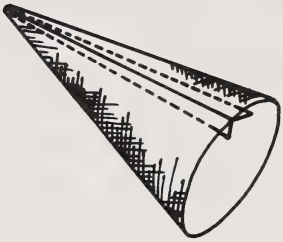


MAKING A COLLECTION NET

1. Gather together: A wooden handle about 1 meter long (broom handles); 1-1 1/2 meters of stiff wire (barrel hoops or telephone wire); a piece of cloth 1 X 1 meter and mosquito netting.

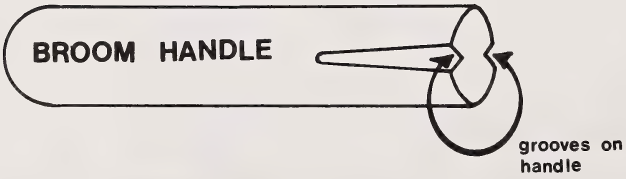
2. Sew the cloth into a V-shaped bag.



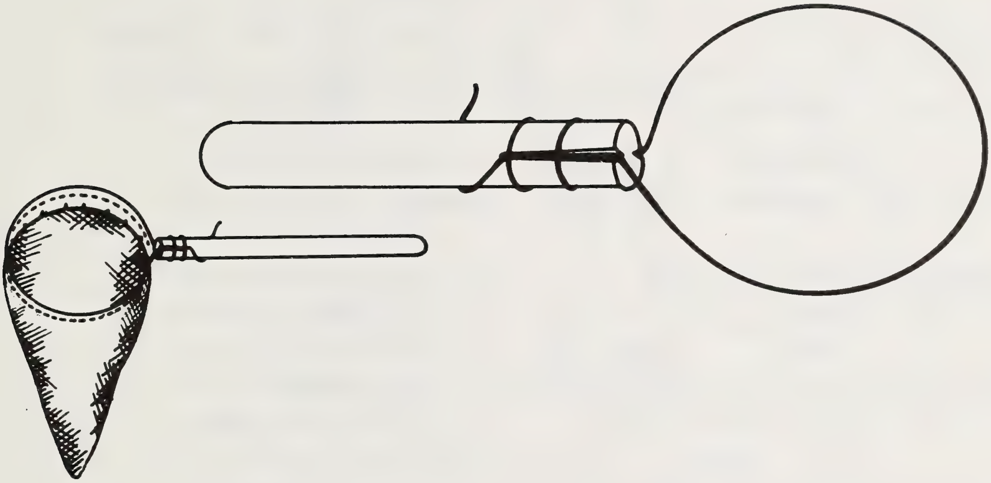


3. Bend the wire into the shape of a hoop.

4. Bore a hole and cut grooves in the broom handle.



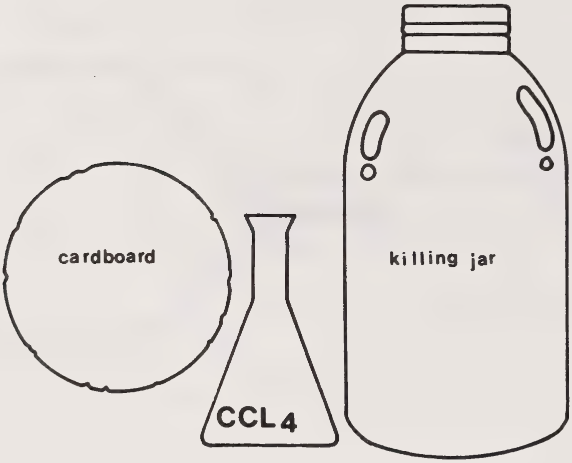
5. Attach the bag to the wire.
6. Attach the wire to the handle.

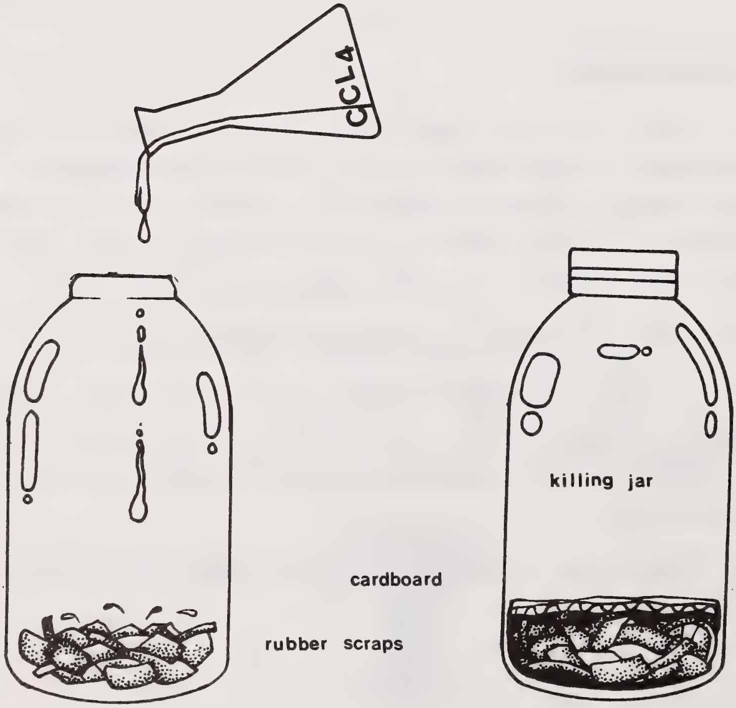


MAKING A KILLING BOTTLE

1. You will need: A pint-sized bottle with a TIGHT fitting lid (wide mouthed jar preferable); a piece of corrugated cardboard (double faced preferred); a small jar of carbon tetrachloride; enough small scraps of rubber (from old jar rings or inner tubes) to cover the bottom of the jar.
2. Cut the cardboard to fit tightly inside the jar.
3. Place the scraps of rubber inside the jar and cover them with carbon tetrachloride. Be sure to follow any directions on the carbon tetrachloride bottle and do this in a well ventilated area.
4. Pour out the excess liquid after the rubber has become saturated.

5. Cover the rubber with the cardboard.
6. Place the lid on tightly.
7. Be sure to label your killing jar and keep it out of the reach of younger children.





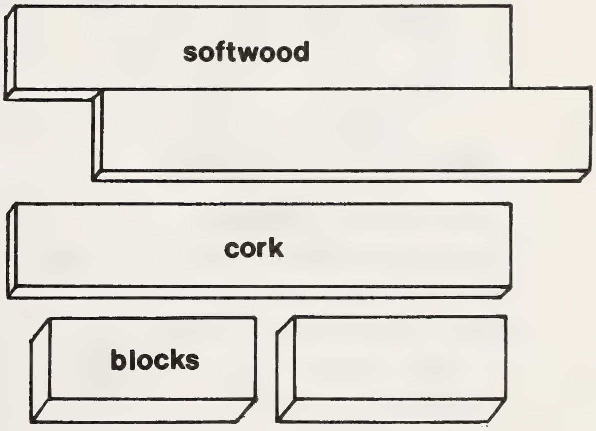
If the jar is sealed tightly, except when insects are being placed in it or removed from it, the carbon tetrachloride will remain active for a month or more.

To recharge the killing bottle remove the cardboard disc and add more carbon tetrachloride as in steps 3 and 4.

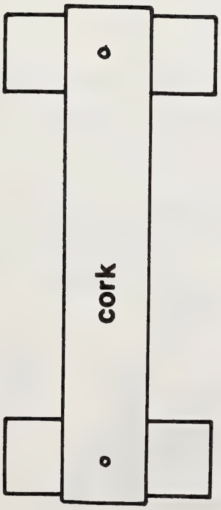
MAKING A SPREADING BOARD

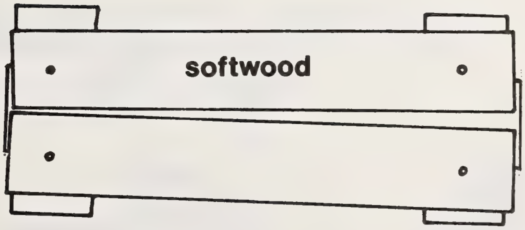
A spreading board is for drying butterflies and moths.

1. You will need: two strips of softwood 0.6 X 5 X 30 cm (1/4 X 2 X 12 inches); one strip of cork or similar material 0.6 X 5 X 30 cm (1/4 X 2 X 12 inches); two wooden blocks 1.27 X 5 X 12 cm (1/2 X 2 X 5 inches).

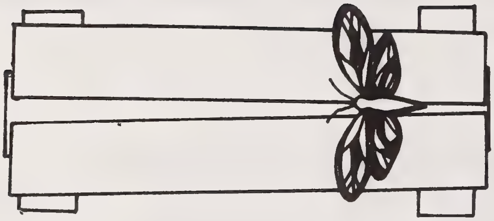


2. Nail the cork strip on to the centers of the wooden blocks. Nail wooden strips on to the blocks leaving the strips about 0.6 cm (1/4 inch) apart at one end and slightly less at the other end.



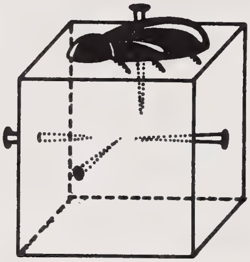


Butterfly on spreading board.



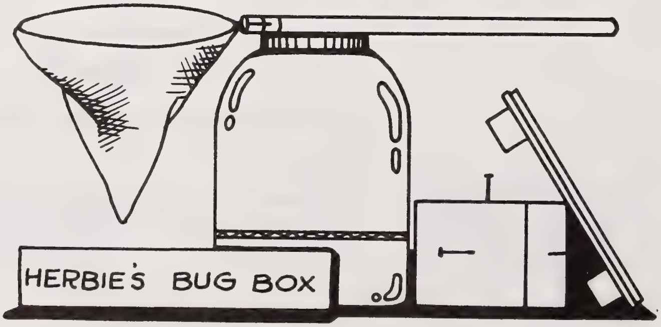
MAKING A PINNING BLOCK

Take a 2.5 cm square piece of wood and drill small holes large enough for a pin on four sides of the block - 1.9,1.2, 0.6 and 0.3 cm.



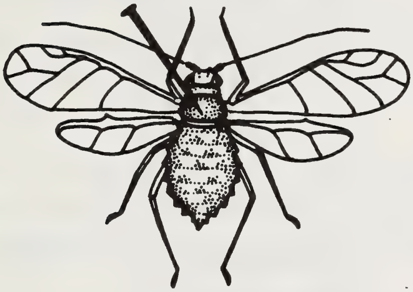
D. MOUNTING AND LABELLING

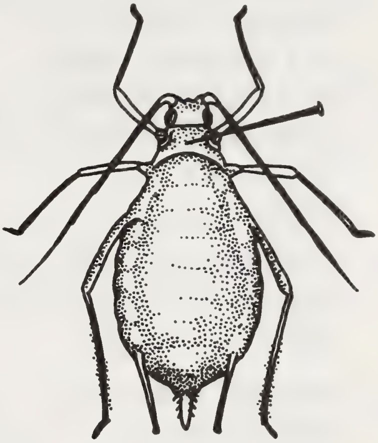
To begin with you must find the insects and catch them with your net and kill them by placing them in the killing bottle. Then you mount them and label them for your collection.



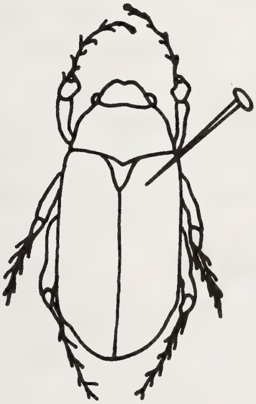
MOUNTING INSECTS

1. For all insects 0.6 cm in size or larger, except moths and butterflies, insert the pin through the thorax.

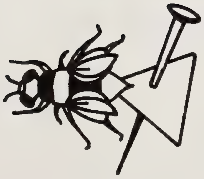


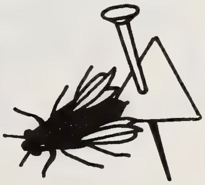


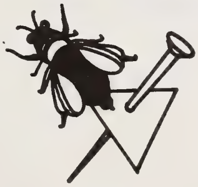
2. With hard backed beetles insert the pin through the right wing.

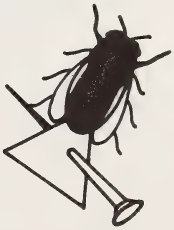


3. For insects smaller than 0.6 cm, cut small triangular pieces of stiff paper, insert pin through paper and attach insect with glue to the tip of the triangular paper.



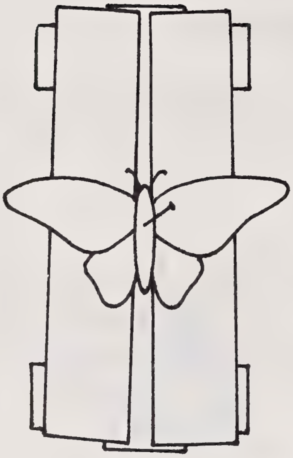


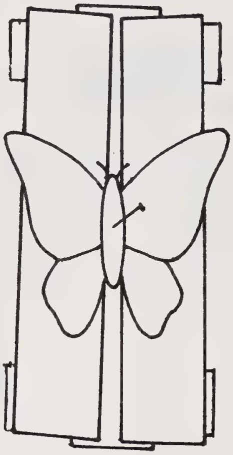


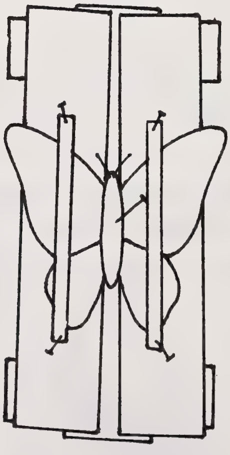


SPREADING BUTTERFLIES AND MOTHS

1. Pin the butterfly before it is dry.
2. Insert the pin through the cork of the spreading board so that the insects body rests on cork between the wood strips.
3. With the point of another pin, move the wings forward.
4. When the wings are spread, place a strip of paper across them. Fasten them with pins.
5. Allow the butterfly to remain on the spreader a few days or until dry.







E. INSECT IDENTIFICATION

Collecting insects can be a lot of fun - but it becomes a more valuable hobby when you can identify them.

For help identifying your insects, approach your local District Agriculturalist.

There are some publications available which will help you. They can be obtained from your local District Agriculturalist's Office.

The following identification series contain excellent color photos and are available from Information Division, Canada Department of Agriculture, Ottawa, Ontario, K1A 0C7:

- #3	Corn Earworm
- #5	European Corn Borer
- #6	The Red Backed Cutworm
- #7	The Pale Western Cutworm
- #9	Oystershell Scale
- #10	Colorado Potato Beetle
- #13	Beet Web worm
- #14	Cereal Leaf Beetle
- #15	Armyworm
- #19	Wheat tem Sawfly
- #29	Migratory Grasshopper
- #30	Imported Cabbageworm

The following publication contains descriptions and color photographs and is available for a fee from the Faculty of Extension, University of Alberta, T6G 2E9.
Insect Pests of Alberta 1977.

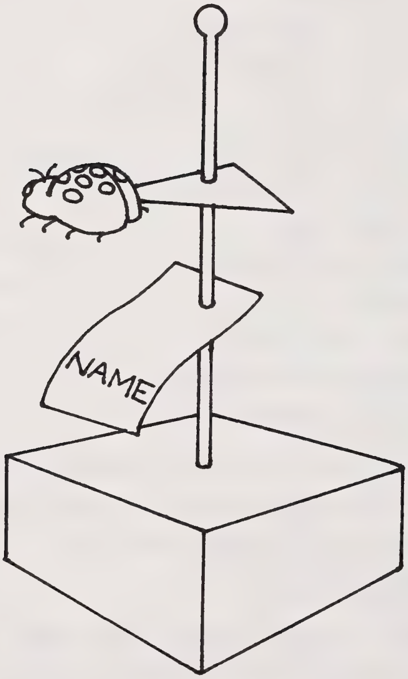
You can collect some of the insects mentioned and any others you can find. If you cannot name a specimen, take it to you leader or to the nearest extension office. If they cannot help you, send a dried sample pinned in a box, to the entomology section of the nearest university.

LABELLING

Labelling is very important. Without proper labels your collection is worthless.

Your labels should tell the name of the insect, where it was collected, when it was collected and who collected it.

Use the pinning block to get the label on the pin underneath the insect.



F. INSECT CONTROL

Destructive insects are killed with chemicals call INSECTICIDES. There are many kinds of chemicals used. Many are found in nature - sulfur, lead, arsenic are common examples. Others are derived from plants and animals. Today however, most insecticides are synthetically manufactured in a laboratory by scientists.

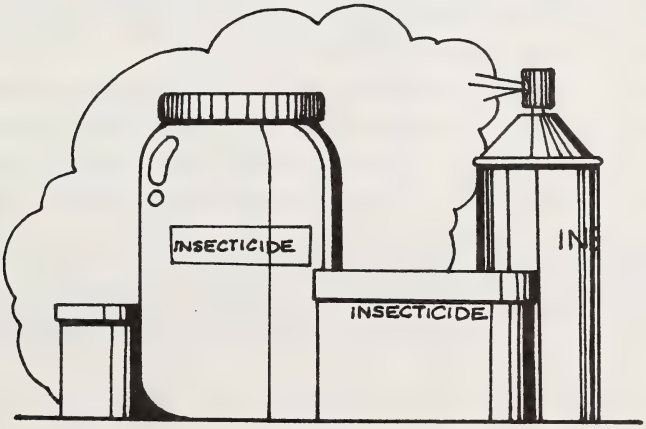
Insecticides are applied in many forms. They are used as dusts, sprays, ointments (on livestock), baits, aerosols, and as soil and seed treatments.

With so many kinds of insecticides, and ways of applying them, it is very important to read labels and follow the manufacturers' instructions. This will protect you the user, and will ensure proper control of the insect pest.

The most recent recommendations regarding chemical insect control are contained in several publications produced by the Alberta Agriculture and are available to project leaders through the nearest agricultural office.

AGDEX 100/622-1	Field Crop Insect Pests of Alberta
AGDEX 100/622	Chemical Control of Field Crop Insects, 1978

These are up-dated yearly so the newest chemicals are always included.



G. HOW IS A NEW PESTICIDE DEVELOPED?

Scientists are continually at work trying to find new and better insecticides. They want to find something which will destroy the pest, but which is safe for man, animals and crops.

When they find something which appears promising they test it out, trying to find the best and safest way to use it and the best way to sell it.

The Canadian government also tests new pesticides. If they are satisfied that it is safe they will license it to be sold in Canada.

All agricultural chemicals sold in Canada must be licensed with the federal government.

Publications that you may find useful are available from Information, Sir John Carling Building, 930 Carling Avenue, Ottawa, Ontario, K1A 0C7.

- What You Should Know About Pest Control (CDA) #1340
- Pesticides - Their Implication for Agriculture (CDA) #1518
- Proper Use of Pesticides Program:

No. 1	The Program
No. 2	How to Use Pesticides
No. 3	Pest Control Products Act
No. 4	Methods of Pest Control
No. 5	Biological Control of Pests
No. 6	Federal Control Product Regulatory Procedure
No. 7	First Aid for Accidents with Pesticides
No. 8	Five Ways to Keep Pesticides on Our Side
No. 9	Safe Use of Pesticides Around Homes and Cottages
No. 10	Pesticide Development
No. 11	Pesticide Waste Disposal
No. 12	Benefits from the Use of Pest Control Products

SOURCES

1. Anonymous, 4-H Field Crops Manual, Manitoba Department of Agriculture.
2. The Canadian Seed Growers' Association, Regulations and Procedures for Pedigreed Seed Crop Production, Circular No. 6-77, published by The Canadian Seed Growers' Association.
3. Field Crops Branch, The Preparation of Seed For Exhibition, Publication No. 71, published by the Alberta Department of Agriculture, 1956.
4. Johnston, Alex, Principles of Forage Conservation, Agdex 120/60-1, published by Alberta Agriculture, 1975.
5. United Grain Growers', 15 Kinds of Wheat Kernel Damage, The Grain Grower, page 112-125, published by United Grain Growers', 1971.
6. United Grain Growers', Know These 10 Kinds of Malting Barley Kernel Damage, The Grain Grower, page 114 - 125, published by United Grain Growers', 1972.

See your local District Agriculturalist for further publications and information on any of these topics.

Special thanks to 4-H Regional Specialists Brian Matthiessen (Red Deer) and Milo Barffus (Lethbridge) for co-operating with the development of this Field Crop Series.

PROJECT EVALUATION

In order to keep meeting your needs in the 4-H program, we would like to request your assistance in completing this evaluation form. Make your suggestions on this sheet as you use this book. After the project has been completed, mail this form to:

Project Evaluation
4-H Branch
Alberta Agriculture
9718 - 107 Street
Edmonton, Alberta
T5K 2C8

(use another page if required)

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